Buffalo River Area of Concern Beneficial Use Impairments

Restrictions on Fish & Wildlife Consumption:
The New York state Department of Health (NYSDOH) issues fish consumption advisories based on fish sampling data collected by the New York State Department of Environmental Conservation (NYSDEC). Concentrations of chemicals found in the fish are compared to the U.S. Food and Drug Administration's (FDA) allowable tolerance levels for food and to New York State criteria for the protection of human health. When high levels of contaminants are found, consumption advisories are issued by the NYSDOH to alert fishermen to the potential adverse health impacts of eating contaminated fish.

Restrictions on fish consumption have been identified as primarily caused by PCBs and chlordane contamination. Elevated levels of mercury may also be of concern in contributing to this use impairment, but have not been tested. These restrictions are part of a lakewide advisory for Lake Erie fish. The sources contributing to this restriction include upstream industrial discharges, inactive hazardous waste sites, contaminated sediments, air deposition and Lake Erie.

Based on data quantifying contaminant levels in fish tissue, specific fish consumption advisories have been issued in the Buffalo River and its tributaries. The fish species that are listed for these waters have contaminant levels that exceed federal food standards or state human health criteria and are described in the original RAP document. A more thorough discussion on fish consumption advisories and testing protocols is found in the 2005 RAP Status Report.

The following NYSDOH fish consumption advisories exist for the Buffalo River AOC:
- Eat no carp from the Buffalo River or Harbor *(due to PCB contamination);*
- Women of childbearing age and infants and children under the age of 15 should not eat any species from the Buffalo River or Harbor;

The following fish consumption advisories exist for Lake Erie and may apply to fish found in the Buffalo River:
- Women of childbearing age and infants and children under 15 are advised to eat no more than one meal per week of Chinook salmon less than 19 inches, burbot, freshwater drum, lake whitefish, rock bass and perch.
- Women of childbearing age and infants and children under 15 are advised to eat no more than one meal per month of all other fish from Lake Erie.
- Other people should eat no more than one meal per week of any Lake Erie fish species.

In the watershed, the ongoing and planned inactive hazardous waste site remediation and the comprehensive point source discharge control program contribute to the restoration and protection of the beneficial use. The establishment and implementation of Best Management Practices (BMPs) for fish, aquatic and wildlife as well as human health will also benefit the restoration and protection of this and other beneficial uses. The Buffalo River RAC has identified two restoration targets for the consumption impairment.

No wildlife consumption advisory exists specific to the Buffalo River, although a statewide waterfowl consumption advisory has been issued to "eat no mergansers since they are the most heavily contaminated waterfowl species" and to limit consumption of other waterfowl to two meals per month.

The Buffalo River RAC and Riverkeeper have identified two delisting criteria/restoration targets for the consumption impairment.

Tainting of Fish & Wildlife Flavor:

The substances of primary concern for tainting of fish in the Buffalo River are phenols, especially those that are chlorinated. A noticeable PAH odor has been observed in the stomach content of some fish. The potential for tainting of fish flesh from substances present in river sediments appears to be sufficiently high to cause fish tainting among bottom feeding species. Further assessment by the Buffalo River RAC and Riverkeeper is planned for 2006-08.

Degradation of Fish & Wildlife Populations:
This beneficial use is considered "likely impaired" and is undergoing a full re-assessment. The diversity (species and abundance) of fish in the Buffalo River is an important indicator of the health of the ecosystem. The addition of primary and secondary wastewater treatment for point source discharges to the river has contributed significantly to improved populations. Observations in 1928 concluded the lower river was "unfit...and contained no form of fish life"; however, in an early 1980's study, more than twenty fish species were observed.

Though the species richness of benthic macroinvertebrates has improved since the 1970s, recent research indicates that the improvements have stagnated, and some data even indicate a decrease in the health of the benthic community since the early 1990s. Reduced organic enrichment levels have been observed; however, the biotic index or organisms' tolerance to organic enrichment has also been observed to decrease slightly. Organic enrichment reduces dissolved oxygen levels. The lower Buffalo River has a reduced DO content (<4mg/L) during the summer months with sharp increases during storm events, occasionally reaching values of 1,000 NTUs.

A two-year bird population study is underway, and efforts to quantify and assess mammal and herpetological populations are being coordinated for 2006-08. Recent larval fish sampling showed similar species diversity and abundance in 2003-04 as compared to 1993 (8-10 species found). The adult/juvenile fish sampling showed similar species diversity and abundance in 2003-04 compared to 1993 (15-20 species across all sites). The lowest species diversity occurred at the sites in the upper-most and lower-most reaches of the AOC impact area.

Further assessment by the Buffalo River RAC and Riverkeeper is planned for 2006-08.

Fish Tumors or Other Deformities:
High levels of fish tumors indicate contaminant stresses in the ecosystem that interfere with human beneficial uses. A number of studies involving Black et al. show that extracts of Buffalo River sediments cause liver and skin neoplasia in brown bullheads. One can infer that the observed elevated liver and skin neoplasia is caused partly at least by polynuclear aromatic hydrocarbons (PAHs) in the Buffalo River sediments. Other causative agents associated with the sediments cannot be ruled out. Recent research on fish tumors indicates that for the river as a whole, DELT (Deformities, Eroded fins, Lesions, and Tumors) anomaly scores in fish averaged 37%, which is much higher that what would be expected for a moderately impacted (2-5%) or unimpacted (<2%) river. The rate varied greatly among species, with a low of 14% in pumpkinseed to an extremely high rate of 87% in brown bullhead. The other most commonly found species had the following DELT scores: common carp 67%, gizzard shad 51%, largemouth bass 34%, and golden shiner 22%. The Buffalo River RAC and Riverkeeper have identified a restoration target for the tumor and deformities impairment.

Bird or Animal Deformities or Reproductive Problems:
While there are no direct data to indicate bird or animal deformities or reproduction problems along the Buffalo River, the exceedance of certain criteria of chemical contaminants in fish used as food by birds and other animals suggest that such effects are likely. Levels of PCBs sampled in carp adult fish and young-of-the-year spottail shiners exceed criteria for the protection of fish-eating wildlife. Further assessment by the Buffalo River RAC and Riverkeeper is planned for 2006-08.

Degradation of Benthos:

Sample measurements of benthic macroinvertebrates and results of toxicity tests conducted in a study in 1982 indicated the presence of contaminated sediment in certain areas of the Buffalo River. The sediments in selected areas were evaluated as causing a degradation of benthos use impairment in the AOC. Unlike the Niagara River, which has a swift river channel flow that creates sediment pockets at certain tributary mouths and nearshore areas, the Buffalo River has a slower current with river segment bends that create additional areas for sediment deposits.

Research conducted from 2003-04 confirms that the Buffalo River AOC continues to be dominated by a low diversity benthic invertebrate community that is broadly tolerant of pollution and environmental degradation. High densities of tubificid oligochaeates (though lower than historic maxima), and their numerical dominance of the benthos suggest poor environmental health. Oligochaete densities were higher in the channel than at shoreline habitat restoration sites. Fewer invertebrate families were collected in this study than in the 1990s, possibly even indicating some reversal of biotic recovery. Substantially more families occurred at shoreline sites than in the navigational channel, although the habitat restoration sites were still dominated by pollution-tolerant oligochaetes and chironomids. Likewise, chironomid taxonomic richness was markedly higher at the habitat sites than in the channel, but species largely constituted pollution-tolerant species and genera. Chironomid mouthpart deformities remain very high (54.5%) within the navigational dredge channel, but interestingly, all of the rather limited number of larvae from shoreline sites had developed normally.

The Buffalo River RAC and Riverkeeper have identified two delisting criteria/restoration targets for the benthos impairment.

Restrictions on Dredging Activities:
Sample measurements of benthic macroinvertebrates and results of toxicity tests conducted in a study in 1982 indicated the presence of contaminated sediment in certain areas of the Buffalo River. The sediments in selected areas were evaluated as causing a degradation of benthos use impairment in the AOC. Since then numerous efforts, including U.S. EPA's ARCS program, have sampled hundreds of cores of Buffalo River sediment. Whereas newer sediment generated from the upper watershed is cleaner, the river is laden with historical contaminated sediments. The PCBs, PAHs and metals in the contaminated sediments within the dredged commercial channel require controlled disposal, which currently occurs in CDF #4. The CDF is currently 60% full and will reach capacity by 2015.

The USACE-Buffalo District and FBNR have signed a landmark $2.1 million cost share agreement for the implementation of the Buffalo River Environmental Dredging Feasibility Study. Among other goals, the Feasibility Study (FS), which began in April 2005, will identify and quantify potential O&M benefits that could be achieved through the use of environmental dredging. The FS is expected to take 2-3 years, and included a comprehensive sediment sampling project by NYSDEC from August-September 2005. Nearly 400 samples were taken from nearly 180 cores stretching from the confluence of Buffalo River and Cazenovia Creek to the foot of Hamburg Street. At the end of the FS, sediment remediation alternatives will be evaluated and chosen, and additional funding will be pursued for remediation.

The Buffalo River RAC and Riverkeeper have identified a restoration target for the dredging impairment.

Eutrophication or Undesirable Algae:
The presence of eutrophication or undesirable algae, specifically the presence of microcystins (toxic algae) in the Buffalo River is unknown. Further assessment by the Buffalo River RAC and Riverkeeper is planned for 2006-08.

Degradation of Aesthetics:
The aesthetic values of the Buffalo River have been newly designated as "impaired" due to floatables, debris and foul odor. These conditions result from Combined Sewer Overflows within

the City of Buffalo as well as poorly maintained septic systems and runoff from the upper watershed. The Buffalo River RAC and Riverkeeper have identified two delisting criteria/restoration targets for the aesthetics impairment.

Degradation of Phytoplankton & Zooplankton Populations:
Zooplankton populations have been determined to be "not impaired". Findings from a 1992 survey indicate that, overall, the zooplankton community in the river appears to be at least as diverse as that in the inshore areas of Lake Erie, and does not reflect the impacted nature of the river to nearly the extent of the benthic macroinvertebrate community (Snyder 1993).

Conversely, not enough information and data exists for phytoplankton populations (BUI #13) to make an accurate determination of its status. Phytoplankton is a good indicator of a waterbody's trophic state and potential for fish production. Initial sampling in 1978 by Frederick and Booth looked at three locations in the lower Buffalo River. The study revealed that the highest concentrations of phytoplankton in the river occurred in the upstream portion and progressively decreased downstream towards the mouth. A subsequent survey in 1992 at four sites revealed a general absence of Cyanophyta (blue-green algae) at the upper and lower reaches of the river, but abundant levels in the meandering section of the river. The green algae, *Scenedesmus*, were found throughout the river in relatively high numbers. Schero (1993) suspected that this may reflect the ability of the algae to survive in the turbid, organically enriched waters of the Buffalo River (Poole et al., 1994). Further assessment by the Buffalo River RAC and Riverkeeper is planned for 2006-08.

Loss of Fish & Wildlife Habitat:
In addition to impacting fish and wildlife populations, the loss of fish and wildlife habitat impairs other beneficial uses such as fishing, wildlife observation, and outdoor recreation. The Buffalo River ecosystem once provided plentiful habitat for reproduction, feeding and growth, and a migratory route for a myriad of fish, birds and wildlife. Writings from the 1600's describe the Buffalo River as an extensive marsh with temporary hunting and fishing camps built by native peoples along its shore. It is believed that the quality of the river during this period must have been such as to sustain a diverse and abundant warmwater fishery and wildlife community (Poole et al., 1994).

The lower Buffalo River is heavily bulkheaded to facilitate shipping activities that have endured since the 1800's. This bulkheading along with the maintenance dredging have resulted in major modifications to the natural habitat. As a result, shallow water habitat and wetlands have been lost and rooted aquatic vegetation is lacking. It is also likely that habitat loss has contributed to the degradation of fish and wildlife populations.

With the decline of industry and shipping on the Buffalo River, it may be feasible to restore some of the fish and wildlife habitat previously lost. An assessment of potential habitat restoration sites in the Buffalo River AOC was completed in October 2005. The resulting data and report include an evaluation matrix of 10 potential restoration areas within the AOC impact area. The report is available as a .pdf on Riverkeeper's website (www.fbnr.org). More data and information is needed regarding habitat quantification throughout the AOC as well as a pervious vs. impervious surface analysis.

The Buffalo River RAC and Riverkeeper have established preliminary qualitative delisting criteria/restoration targets for this use impairment, however further research and habitat assessment is planned for 2006-08.